Amendments to the Claims

This listing of claims replaces all prior versions and listings of the claims in this application.

Listing of Claims

1. (Currently amended) A medical pump for use with a pumping chamber, comprising:

a plunger, disposed between a passive inlet valve and a passive outlet valve of the pumping chamber, adapted to intermittently pressurize the pumping chamber during a pumping cycle, the pumping cycle defining an attempted fluid delivery stroke of the pump;

a pressure sensor directly connected to the plunger and adapted to detect the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber;

a position sensor operatively associated with the plunger to detect the position of the plunger;

a processing unit in electronic communication with the pressure sensor and position sensor; and

a memory coupled to the processing unit, wherein the memory contains programming code executed by the processing unit to establish an expected nominal stroke volume associated with the attempted fluid delivery stroke of the pump, set a first stroke frequency based upon a desired dosage rate and the expected nominal stroke volume, thence, during pressurization of the pumping chamber for at least one attempted fluid delivery stroke, process pressure data from the pressure sensor and position data from the position sensor to determine a calculated actual stroke volume of the pump for the pumping cycle, and, if the calculated actual stroke volume is greater than a given threshold value, to modify the first stroke frequency to a second stroke frequency different than the first stroke frequency in order to compensate for variation between the calculated actual stroke volume and the expected nominal stroke volume so as to more closely approach the desired dosage rate during a subsequent pumping cycle; and

wherein the ~~pumping chamber has a~~ passive outlet valve is operated by the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber, and the programming code executed by the processing unit processes pressure data from the pressure sensor to identify when the passive outlet valve has opened.

2. (Original) The medical pump of claim 1, wherein the pressure sensor is the only pressure sensor included in the medical pump.

3. - 8. (Cancelled)

9. (Currently Amended) The medical pump of claim 1, wherein the programming code executed by the processing unit processes pressure data and position data to determine a calculated pressurization volume from a beginning of a compression stroke of the pumping cycle to the point when the passive outlet valve opens, and uses the calculated pressurization volume to determine the calculated actual stroke volume.

10. (Previously Presented) The medical pump of claim 9, wherein the programming code executed by the processing unit determines a change in pressurization volume by subtracting the calculated pressurization volume from a nominal pressurization volume, determines a change in stroke volume by multiplying the change in pressurization volume by a ratio of pumping chamber expansion under pressure at the end of the compression stroke to pumping chamber expansion under pressure at the beginning of the compression stroke of the pumping cycle, and determines the calculated actual stroke volume based on the change in stroke volume.

11. (Original) The medical pump of claim 1 further comprising a cassette for defining the pumping chamber.

12. (Previously Presented) The medical pump of claim 1, wherein the pumping chamber is pressurized for a plurality of attempted fluid delivery strokes and the calculated actual stroke volume is an average taken over the plurality of attempted fluid delivery strokes..

13. – 22. (Cancelled)

23. (Currently amended) A medical pump for use with a pumping chamber, comprising:
a plunger, disposed between a passive inlet valve and a passive outlet valve of the pumping chamber, adapted to intermittently pressurize the pumping chamber during a pumping cycle, the pumping cycle defining an attempted fluid delivery stroke of the pump;

a pressure sensor directly connected to the plunger and adapted to detect the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber;

a position sensor operatively associated with the plunger to detect the position of the plunger;

a processing unit in electronic communication with the pressure sensor and position sensor; and

a memory coupled to the processing unit, wherein the memory contains programming code executed by the processing unit to establish an expected nominal stroke volume associated with the attempted fluid delivery stroke of the pump, set a first stroke frequency based upon a desired dosage rate and the expected nominal stroke volume, thence, during pressurization of the pumping chamber for at least one attempted fluid delivery stroke, process pressure data from the pressure sensor and position data from the position sensor to:

identify by a slope change in the pressure data when the passive [[an]] outlet valve of the pumping chamber has opened,

determine a calculated pressurization volume from a beginning of the pumping cycle to the point when the passive outlet valve opens,

determine a change in pressurization volume by subtracting the calculated pressurization volume from a nominal pressurization volume,

determine a change in stroke volume by multiplying the change in pressurization volume by a ratio of pumping chamber expansion under pressure at the end of the compression stroke of the pumping cycle to pumping chamber expansion under pressure at the beginning of a compression stroke of the pumping cycle,

determine a calculated actual stroke volume based on the change in stroke volume, and, if the calculated actual stroke volume is greater than a given threshold value,

modify the stroke frequency to a second stroke frequency that is different than the first stroke frequency in order to compensate for variation between the calculated actual stroke volume and the expected nominal stroke volume; and

wherein the ~~outlet valve of the pumping chamber is a~~ passive outlet valve is operated by the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber.

24. (Original) The medical pump of claim 23 further comprising a cassette for defining the pumping chamber.

25. (Currently amended) A medical pump for use with a cassette having a pumping chamber, comprising:

a plunger, disposed between a passive inlet valve and a passive outlet valve of the pumping chamber, operatively associated with a shaft and adapted to intermittently pressurize the pumping chamber during a pumping cycle, the pumping cycle defining an attempted fluid delivery stroke of the pump;

a pressure sensor directly connected to the plunger and positioned in-line with the plunger between the pumping chamber and the shaft, the pressure sensor being adapted to detect the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber;

a position sensor operatively associated with the plunger to detect the position of the plunger;

a processing unit in electronic communication with the pressure sensor and position sensor; and

a memory coupled to the processing unit, wherein the memory contains programming code executed by the processing unit to establish an expected nominal stroke volume associated with the attempted fluid delivery stroke of the pump, set a first stroke frequency based upon a desired pump flow rate and the expected nominal stroke volume, thence, during pressurization of the pumping chamber for at least one attempted fluid delivery stroke, to process pressure data from the pressure sensor and position data from the position sensor to determine a calculated actual stroke volume of the pump for the pumping cycle, and to modify the first stroke frequency to a second stroke frequency different than the first stroke frequency in order to compensate for variation between the calculated actual stroke volume and the expected nominal stroke volume so as to more closely approach the desired pump flow rate for a subsequent pumping cycle; and

wherein the ~~pumping chamber has a~~ passive outlet valve is operated by the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber, and the programming code executed by the processing unit processes pressure data from the pressure sensor to identify when the passive outlet valve has opened.

26. – 30. (Cancelled)

31. (Previously Presented) The medical pump of claim 10, wherein the expected nominal pressurization volume comprises multiple nominal pressurization volumes averaged together.

32. (New) The medical pump of claim 1, wherein the plunger is disposed against a flexible membrane of the pumping chamber between the passive inlet valve and the passive outlet valve, and the plunger is adapted to displace the flexible membrane to compress the pumping chamber and open the passive outlet valve.

33. (New) The medical pump of claim 1, wherein the pressure sensor directly detects the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber without using any intervening elements between the pressure sensor and the plunger.

34. (New) The medical pump of claim 1, wherein the plunger is the only plunger used to intermittently pressurize the pumping chamber.

35. (New) The medical pump of claim 23, wherein the plunger is disposed against a flexible membrane of the pumping chamber between the passive inlet valve and the passive outlet valve, and the plunger is adapted to displace the flexible membrane to compress the pumping chamber and open the passive outlet valve.

36. (New) The medical pump of claim 23, wherein the pressure sensor directly detects the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber without using any intervening elements between the pressure sensor and the plunger.

37. (New) The medical pump of claim 23, wherein the plunger is the only plunger used to intermittently pressurize the pumping chamber.

38. (New) The medical pump of claim 25, wherein the plunger is disposed against a flexible membrane of the pumping chamber between the passive inlet valve and the passive outlet valve, and the plunger is adapted to displace the flexible membrane to compress the pumping

chamber and open the passive outlet valve.

39. (New) The medical pump of claim 25, wherein the pressure sensor directly detects the pressure, between the passive inlet valve and the passive outlet valve, exerted by the plunger on the pumping chamber without using any intervening elements between the pressure sensor and the plunger.

40. (New) The medical pump of claim 25, wherein the plunger is the only plunger used to intermittently pressurize the pumping chamber.